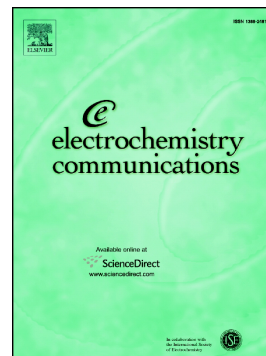


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## Electrochemical desulfurization of solid copper sulfides in strongly alkaline solutions

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**Abstract:** Extraction of metals from their sulfide minerals without emitting  $\text{SO}_2$  could realize an environment-friendly metallurgical route. Here we demonstrate an electrochemical pathway to reduce solid copper sulfide to copper powder in a 50 wt.% NaOH solution. Unlike oxides, most sulfides are semiconductors or electrical conductors and have less formation energy than that of oxides, resulting in a small polarization during electrolysis and less theoretical dissociation potentials. The use of the strongly alkaline solution suppresses the generation of  $\text{H}_2$ , and the electrolyte could dissolve  $\text{S}^{2-}$  and then shuttle the  $\text{S}^{2-}$  between cathode and anode. Moreover, a transparent cell was assembled to directly observe the reduction process of solid copper sulfide. On the anode side, the irreversibility of anodic reactions prevents the parasitic reactions, thereby ensuring a current efficiency over 90%. This electrochemical pathway could be employed for extracting various metals from their sulfides without  $\text{SO}_2$  emissions.

**Keywords:** Electro-desulfurization, copper sulfide, alkaline solution, copper, inert anode

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